

# Tannin

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**Tannins** are astringent, bitter-tasting plant polyphenols that bind and precipitate proteins. The term tannin refers to the source of tannins used in tanning animal hides into leather; however, the term is widely applied to any large polyphenolic compound containing sufficient hydroxyls and other suitable groups (such as carboxyls) to form strong complexes with proteins and other macromolecules. Tannins have molecular weights ranging from 500 to over 3,000.<sup>[1]</sup>

Tannins are usually divided into hydrolyzable tannins and condensed tannins (proanthocyanidins). At the center of a hydrolyzable tannin molecule, there is a polyol carbohydrate (usually D-glucose). The hydroxyl groups of the carbohydrate are partially or totally esterified with phenolic groups such as gallic acid (in gallotannins) or ellagic acid (in ellagitannins). Hydrolyzable tannins are hydrolyzed by weak acids or weak bases to produce carbohydrate and phenolic acids. Condensed tannins, also known as proanthocyanidins, are polymers of 2 to 50 (or more) flavonoid units that are joined by carbon-carbon bonds, which are not susceptible to being cleaved by hydrolysis. While hydrolyzable tannins and most condensed tannins are water soluble, some very large condensed tannins are insoluble.

Tannins may be employed medicinally in antidiarrheal, hemostatic, and antihemorrhoidal compounds. Also, they produce different colors with ferric chloride (either blue, blue black, or green to greenish black) according to the type of tannin.

Examples of gallotannins are the gallic acid esters of glucose in tannic acid ( $C_{76}H_{52}O_{46}$ ), found in the leaves and bark of many plant species.

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## Foods with tannins

### Tea

The tea plant (*Camellia sinensis*) is an example of a plant said to have a naturally high tannin content. When any type of tea leaf is steeped in hot water it brews a "tart" (astringent) flavor that is characteristic of tannins. This is due to the catechins and other flavonoids. Tea "tannins" are chemically distinct from

other types of plant tannins such as tannic acid<sup>[2]</sup> and tea extracts have been reported to contain no tannin<sup>[3]</sup>.

## **Wine**

Tannins (mainly condensed tannins) are also found in wine, particularly red wine. Tannins in wine can come from many sources and the tactile properties differ depending on the source. Tannins in grape skins and seeds (the latter being especially harsh) tend to be more noticeable in red wines, which are fermented while in contact with the skins and seeds. Tannins extracted from grapes are condensed tannins, which are polymers of procyanidin monomers. Hydrolysable tannins are extracted from the oak wood the wine is aged in. Hydrolysable tannins are more easily oxidised than condensed tannins.

Modern winemakers take great care to minimize undesirable tannins from seeds by crushing grapes gently to extract their juice. Pressing the grapes results in press wine which is more tannic and might be kept separately. Wines can also take on tannins if matured in oak or wood casks with a high tannin content. Tannins play an important role in preventing oxidation in aging wine and appear to polymerize and make up a major portion of the sediment in wine.

Recently, a study in wine production and consumption has shown that tannins in the form of procyanidins, have a beneficial effect on vascular health. The study showed that tannins suppressed production of the peptide responsible for hardening arteries. To support their findings, the study also points out that wines from the regions of southwest France and Sardinia are particularly rich in procyanidins, and that these regions also produce populations with longer life spans.<sup>[4]</sup>

## **Fruits**

### **Pomegranates**

Pomegranates contain a diverse array of tannins, particularly hydrolysable tannins. The most abundant of pomegranate tannins are called punicalagins. Punicalagins have a molecular weight of 1038 and are the largest molecule found intact in rat plasma after oral ingestion<sup>[5]</sup> and were found to show no toxic effects in rats who were given a 6% diet of punicalagins for 37 days.<sup>[6]</sup> Punicalagins are also found to be the major component responsible for pomegranate juice's antioxidant and health benefits<sup>[7]</sup>

Several dietary supplements and nutritional ingredients are available that contain extracts of whole pomegranate and/or are standardized to punicalagins, the marker compound of pomegranate. Extracts of pomegranate are also 'Generally Recognized As Safe' (GRAS) by the United States. It has been recommended to look for pomegranate ingredients that mimic the polyphenol ratio of the fruit, as potent synergistic effects have been observed in 'natural spectrum' extracts, especially pomegranate concentrate normalized to punicalagins.<sup>[8]</sup>

### **Persimmons**

Some persimmons are highly astringent and therefore inedible when they are not extremely ripe (specifically the Korean, American, and Hachiya or Japanese). This is due to the high level of tannins, and if eaten by humans (and many other animals), the mouth will become completely dry, yet the saliva glands will continue to secrete saliva which cannot affect the tannin-laced food.

## Berries

Most berries, such as cranberries<sup>[9]</sup> strawberries and blueberries,<sup>[10]</sup> contain both hydrolyzable and condensed tannins.

## Nutrition

If ingested in excessive quantities, tannins inhibit the absorption of minerals such as iron into the body. This is because tannins are metal ion chelators, and tannin-chelated metal ions are not bioavailable.

Tannins have been shown to precipitate proteins,<sup>[1]</sup> which inhibits the absorption of nutrients in some ruminant animals from high-tannin grains such as sorghum.

## Uses

Tannins are an important ingredient in the process of tanning leather. Oak bark has traditionally been the primary source of tannery tannin, though synthetic tanning agents are also in use today.

Iron gall ink utilizes the tannin collected from galls, typically from oak trees.

Tannin is a component in a type of industrial particleboard adhesive developed jointly by the Tanzania Industrial Research and Development Organization and Forintek Labs Canada.

## References

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## External links

- Tannin and wine making! (<http://www.pressedforwine.com/ingredients/tannin.shtml>)
- Tannins: fascinating but sometimes dangerous molecules (<http://www.ansci.cornell.edu/plants/toxicagents/tannin/>)
- Tannin Chemistry (<http://www.users.muohio.edu/hagermae/tannin.pdf>)PDF (1.41 MiB)

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Categories: Oenology | Organic polymers | Flavonoids | Nutrition

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## Safety data for tannic acid

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Glossary of terms on this data sheet.

The information on this web page is provided to help you to work safely, but it is intended to be an overview of hazards, not a replacement for a full Material Safety Data Sheet (MSDS). MSDS forms can be downloaded from the web sites of many chemical suppliers.

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### General

Synonyms: gallotannic acid, gallotannin, glycerite, tannin

Molecular formula:  $C_{76}H_{52}O_{46}$

CAS No: 1401-55-4

EC No: 215-753-2

### Physical data

Appearance: white or light yellow powder

Melting point: 210 C

Boiling point:

Vapour density:

Vapour pressure:

Density ( $g\ cm^{-3}$ ):

Flash point: 199 C (closed cup)

Explosion limits:

Autoignition temperature:

Water solubility:

### Stability

Stable. Incompatible with metallic salts, strong oxidizing agents, iron and other heavy metals.

### Toxicology

Not hazardous according to Directive 67/548/EEC.

#### Toxicity data

(The meaning of any abbreviations which appear in this section is given here.)

ORL-RAT LD50 2260 mg kg<sup>-1</sup>

IPR-MUS LD50 120 mg kg<sup>-1</sup>

ORL-RBT LD50 5000 mg kg<sup>-1</sup>

**Risk phrases**

(The meaning of any risk phrases which appear in this section is given [here](#).)

**Transport information**

Non-hazardous for air, sea and road freight.

**Personal protection**

Minimize contact.

**Safety phrases**

(The meaning of any safety phrases which appear in this section is given [here](#).)

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